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RESEARCH

Factors associated with osteoporosis among older patients at the Geriatric Centre in Nigeria: a cross-sectional study

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Background: Osteoporosis is a silent disabling clinical condition often attributed to ageing. It is of public health importance because of its complications and attendant morbidity and mortality.
Methods: A cross-sectional study was undertaken of 2401 older patients (60 years and above) at the Geriatric Centre, University College Hospital, Ibadan. Candidate variables such as socio-demographic characteristics, anthropometric indices, physical and lifestyle habits were assessed. Bivariate and multivariate analyses were carried out using SPSS 17®.
Results: The point prevalence of osteoporosis was 56.9% (males = 43.7% and females = 65.8%). The most significant factors associated with osteoporosis on logistics regression analyses were increasing age, female sex, lack of formal education, lack of engagement in occupational activities and living with relatives/friends. Receiving social support from relatives/friends, non-participation in sporting activities at younger ages, prolonged use of medications for peptic ulcer disease, hospitalisation on or after the age of 60 years and asthenic build were also found to be significant. Yearly increase in age shows a 6.9% (95% CI 5.4–8.4%) increase in the odds of having osteoporosis.
Conclusion: The high prevalence of osteoporosis among older persons in this study calls for concerted efforts by the healthcare workers to prevent osteoporosis among older patients.

Keywords: Geriatric centre, Nigeria, older patients, osteoporosis

Background

Osteoporosis is a progressive disease with loss of bone mass which leaves the skeleton vulnerable to fracture.[1] It is a systemic skeletal disease in which there is micro-architectural deterioration of bone tissue.[2] Osteoporosis is operationally defined using the World Health Organization (WHO) criteria as a bone mineral density (BMD) that lies 2.5 standard deviations or more below the average value for young healthy women (a T-score of < –2.5 SD).[3,4] Dual-energy X-ray absorptiometry (DXA) is commonly used to measure BMD.[3]

The WHO scientific group on the assessment of osteoporosis at the primary healthcare level in the report of the meeting held in Brussels, Belgium in 2004 noted that osteoporosis is a disease that has to be prevented in view of its severe morbidities and associated fragility fractures among the elderly because these cause a huge impact, financial and social, on the health of the community.[3,5] Osteoporosis is also known to affect the quality of life and independence of the elderly.[3] With increasing life expectancy in Nigeria, the population of the elderly being hospitalised following fractures of the head of the femur is on the rise.[1] The vertebral bodies, distal radius, neck of femur, proximal femur and proximal humerus are the areas of highest prevalence of fractures.[4]

Osteoporosis can be divided into primary osteoporosis, which includes age-related and idiopathic osteoporosis, and secondary osteoporosis.[6] The causes of secondary osteoporosis include but are not restricted to hypogonadism such as arises from hormonal treatment of prostate cancer, lifestyle choices such as a sedentary lifestyle, alcohol and cigarette consumption, gastrointestinal disorders, systemic illnesses and medications such as glucocorticoids.[6]

In the United Kingdom (UK), more than 200,000 fractures are reported each year secondary to osteoporosis.[4] In America, the prevalence rate of osteoporosis is 10.3%, which translates to 28 million people, of which 10 million have osteoporosis and 18 million have low BMD.[7] In Australia, 1.2 million people are reported to have osteoporosis,[8] whilst in India postmenopausal women commonly suffer from osteoporosis,[9] although osteoporosis is as important in men as it is in women.[6] The risk factors associated with osteoporosis include a positive family history of osteoporosis, lack of exercise, vitamin D deficiency and a low-calcium diet.[9] Prolonged amenorrhoea and a history of anorexia or bulimia are also implicated in the development of osteoporosis.[9] Significant increase in total homocysteine (tHcy) with corresponding decreases in folic acid, vitamins B12 and B6 were identified as the risk factors causing a decrease in BMD in osteoporotic Nigerian adults using DXA measurement.[10]

In a case-control study conducted at the National Orthopaedic Hospital Igbobi, Lagos, Nigeria over a 12-month period, 31 patients ranging from 67 to 100 years with a mean age of 79.6 years were recruited.[1] The majority of those in the study group with osteoporosis were female and most were post-menopausal; also virtually all the patients were above 70 years of age.[1] Similarly, in a cross-sectional study among 208 Nigerian women, broadband ultrasound attenuation (BUA) and speed of sound velocity (SOS) were used to calculate the stiffness index

(SI) of the calcaneus.[11] In this total study group, 9% had T-scores indicative of osteoporosis, based on United States (US) reference data.[11] Among Nigerians living with the human immunodeficiency virus (HIV), the BMD values revealed osteoporosis in 31.9% and osteopenia in 46.6%.[12]

To our knowledge, there is a paucity of data on osteoporosis in Nigeria using DXA measurement, as osteoporosis has been sparingly studied. Furthermore, the few studies available were carried out in young and pregnant women. This has left a knowledge gap in the frequency of the condition among elderly patients and the effects of the interventions used in managing this condition. Most healthcare workers and elderly patients become aware of osteoporosis when a fracture has occurred, most often after an innocuous injury. The aim of healthcare workers should be to prevent fractures from occurring in elderly patients as studies have shown high morbidity and mortality following fractures in older persons. This study will increase the knowledge of healthcare workers and increase their awareness of the public health impact of osteoporosis among elderly patients. Additionally, it will serve as a reference point for policy-makers in the health sector to understand the magnitude and modifiable factors to be urgently and properly addressed to prevent osteoporosis in elderly people.

Methods

Study site

This study was carried out at the Chief Tony Anenih Geriatric Centre (CTAGC) of University College Hospital (UCH), Ibadan. Ibadan is the capital city of Oyo State in South-Western Nigeria and it has a population of 3.6 million inhabitants, while Oyo State as a whole has 5.6 million people.[13] University College Hospital, Ibadan is the premier teaching hospital in Nigeria with 850-bed capacity. CTAGC was the first purpose-built geriatric centre in West Africa, established on November 17, 2012, to give holistic care to elderly patients seeking care at UCH. CTAGC has recreational facilities, a dietetics unit, a medical social work unit, a physiotherapy unit, a one-stop-shop outpatient clinic, and two operating theatre suites as well as inpatient (ward) services. This study was carried out at the outpatient unit of the CTAGC, UCH.

Aim of the study

The aim of this study was too determine the prevalence of osteoporosis and its associated factors among older patients aged ≥ 60 years in a first-contact care setting.

Study population

Male and female patients aged 60 years and above who presented consecutively at the CTAGC, UCH between February 2013 and August 2014 were included in the study. Those who did not consent or were too ill to participate were excluded. Their ages were determined by direct recall and the use of the table of historical events by Ajayi-Igun.[14]

Study design

This was a cross-sectional study of 2401 older patients aged ≥ 60 years who were selected consecutively as they presented in the clinic. An assumed prevalence of 50%, because there were no local data on prevalence of osteoporosis in older Nigerians, and a precision of 2% were used in calculating the sample size to arrive at 2401 respondents.

Table 1: Socio-demographic characteristics

Factor	Males = 964, *n* (%)	Females = 1437, *n* (%)	Total = 2401, *n* (%)
Age groups (years)			
60–64	204 (21.2)	312 (21.7)	516 (21.5)
65–69	233 (24.2)	374 (26.0)	607 (25.3)
70–74	233 (24.2)	335 (23.3)	568 (23.7)
75–79	171 (17.7)	260 (18.1)	431 (18.0)
≥ 80	123 (12.8)	156 (10.9)	279 (11.6)
Marital status			
Married	819 (85.0)	634 (44.1)	1435 (60.5)
Widowed	131 (13.6)	782 (54.4)	913 (38.0)
Separated	7 (0.7)	11 (0.8)	18 (0.7)
Single	5 (0.5)	5 (0.3)	10 (0.4)
Divorced	2 (0.2)	5 (0.3)	7 (0.3)
Religious groups			
Christianity	618 (64.1)	957 (66.6)	1575 (65.6)
Islam	339 (35.2)	473 (32.9)	812 (33.8)
Traditional and others	7 (0.7)	7 (0.5)	14 (0.6)
Educational attainment			
None	177 (18.4)	669 (46.6)	846 (35.2)
Primary school	163 (16.9)	228 (15.9)	391 (16.3)
Secondary school	276 (28.6)	202 (14.1)	478 (19.9)
Tertiary school	348 (36.1)	338 (23.5)	686 (28.6)
Occupational status			
Not engaged in occupational activities	636 (66.0)	925 (64.4)	1561 (65.0)
Still engaged in occupational activities	328 (34.0)	512 (35.6)	840 (35.0)
Living arrangements			
Alone	117 (12.1)	264 (18.4)	381 (15.9)
With spouse	771 (80.0)	599 (41.7)	1370 (57.1)
With children/grandchildren	70 (7.3)	548 (38.1)	618 (25.7)
With relatives/friends	6 (0.6)	26 (1.8)	32 (1.3)
Financial support			
Self	383 (39.7)	269 (18.7)	652 (27.2)
Spouse	67 (7.0)	131 (9.1)	198 (8.2)
Children/grandchildren	487 (50.5)	1020 (71.0)	1507 (62.8)
Relatives/friends	27 (2.8)	17 (1.2)	44 (1.8)
Social support			
None	15 (1.6)	23 (1.6)	38 (1.6)
Spouse	580 (60.2)	364 (25.3)	944 (39.3)
Children/grandchildren	360 (37.3)	1021 (71.1)	1381 (57.5)
Relatives/friends	9 (0.9)	29 (2.0)	38 (1.6)
Number of children			
0–5	487 (50.5)	903 (62.8)	1390 (57.9)
> 5	477 (49.5)	534 (37.2)	1011 (42.1)

Table 2: Socio-demographic characteristics by prevalence of osteoporosis

Factor	Osteoporosis			
	Yes = 1366, *n* (%)	No = 1035, *n* (%)	Total = 2401, *n* (%)	
Age groups (years)				
60–64	205 (39.7)	311 (60.3)	516 (100.0)	$\chi^2 = 156.500$
65–69	300 (49.4)	307 (50.6)	607 (100.0)	
70–74	341 (60.0)	227 (40.0)	568 (100.0)	
75–79	309 (71.7)	122 (28.3)	431 (100.0)	$p < 0.0001$*
≥ 80	211 (75.6)	68 (24.4)	279 (100.0)	
Sex				
Males	421 (43.7)	543 (56.3)	964 (100.0)	$\chi^2 = 114.800$
Females	945 (65.8)	492 (34.2)	1437 (100.0)	$p < 0.0001$*
Marital status				
Not currently married	640 (67.5)	308 (32.5)	948 (100.0)	$\chi^2 = 72.008$
Currently married	726 (50.0)	727 (50.0)	1453 (100.0)	$p < 0.0001$*
Religious groups				
Christianity	851 (54.0)	724 (46.0)	1575 (100.0)	$\chi^2 = 17.488$
Islam	509 (62.7)	303 (37.3)	812 (100.0)	
Traditional and others	6 (42.9)	8 (57.1)	14 (100.0)	$p < 0.0001$*
Educational attainment				
None	610 (72.1)	236 (27.9)	846 (100.0)	$\chi^2 = 139.800$
Primary school	220 (56.3)	171 (43.7)	391 (100.0)	
Secondary school	237 (49.6)	241 (50.4)	478 (100.0)	$p < 0.0001$*
Tertiary school	299 (43.6)	387 (56.4)	686 (100.0)	
Occupational status				
Not engaged in occupational activities	933 (59.8)	628 (40.2)	1561 (100.0)	$\chi^2 = 15.053$
Still engaged in occupational activities	433 (51.5)	407 (48.5)	840 (100.0)	$p < 0.0001$*
Living arrangements				
Alone	223 (58.5)	158 (41.5)	381 (100.0)	$\chi^2 = 69.283$
With spouse	689 (50.3)	681 (49.7)	1370 (100.0)	
With children/grandchildren	431 (69.7)	187 (30.3)	618 (100.0)	$p < 0.0001$*
With relatives/friends	23 (71.9)	9 (28.1)	32 (100.0)	
Financial support				
Self	251 (38.5)	401 (61.5)	652 (100.0)	$\chi^2 = 155.200$
Spouse	93 (47.0)	105 (53.0)	198 (100.0)	
Children/grandchildren	1001 (66.4)	506 (33.6)	1507 (100.0)	$p < 0.0001$*
Relatives/friends	21 (47.7)	23 (52.3)	44 (100.0)	
Social support				
None	17 (44.7)	21 (55.3)	38 (100.0)	$\chi^2 = 48.115$
Spouse	465 (49.3)	479 (50.7)	944 (100.0)	
Children/grandchildren	868 (62.9)	513 (37.1)	1381 (100.0)	$p < 0.0001$*
Relatives/friends	16 (42.1)	22 (57.9)	38 (100.0)	
Number of children				
0–5	802 (57.7)	588 (42.3)	1390 (100.0)	$\chi^2 = 0.872$
> 5	564 (55.8)	447 (44.2)	1011 (100.0)	$p = 0.350$

*Significant at 5% level of significance.

Procedure

A semi-structured interviewer-administered questionnaire which was pre-tested before the actual study was used. The BMD was measured in the right wrist (radial and ulnar bones) using a Dual Energy X-ray Absorptiometry (DXA) OsteoSys machine (EXA 3000®) (Mmedical ECONET GmbH, Oberhausen, Germany).[15] It provides BMD in g/cm^3 (gold standard) and the T-score within five seconds. This ensures speed, maximum reduction in patients' radiation dose, detailed imaging and analysis as well as excellent precision.[15] Osteoporosis was defined based on the quantitative assessment of BMD using the WHO operational definition of osteoporosis by DXA machine.[16] Respondents with a T-score of < –2.5 were classified as having osteoporosis.[16]

Detailed information on the risk factors for osteoporosis such as socio-demographic characteristics, lifestyle habits, family functionality, previous hospitalisation (age at first hospital admission and number of hospital admission), healthcare utilisation, morbidities and pattern of medications used in the past one year prior to this study were obtained. Comprehensive physical examination and anthropometric measurements of height, weight, waist and hip circumferences were carried out by the researchers. Body mass index (BMI) was calculated by dividing weight (kilogrammes) by height in meters squared and this was graded using the WHO anthropometric classification.[15] Underweight was defined as BMI < 18.4 kg/m^2 with 18.5–24.9 kg/m^2 as normal. Overweight was a BMI of 25.0–29.9 kg/m^2 and obesity a BMI ≥ 30.0 kg/m^2.[17] The average distance walked by the respondents was estimated from the number of electric poles they walk daily (50 metres between two poles). The administration of the questionnaire was carried out in the English language and Yoruba language (the local dialect of most respondents) and it took about 45 minutes to be administered to each respondent.

Consent for the study

Approval for the study was obtained from the University of Ibadan/University College Hospital Institutional Ethical Review Board. Informed consent of each respondent was obtained before administration of questionnaires.

Respondents' follow-up: Those who were diagnosed with osteoporosis were treated with bisphosphonate (alendronate or ibandronate) and calcium supplement. The administered questionnaires were cleaned and analysed using SSPS® version 17 (SPSS Inc, Chicago, IL, USA). Chi-square statistics was used to test the association between categorical variables and Student's t-test to test the association between continuous variables. The level of significance was set at $p \leq 0.05$. Logistic regression was used to explore relationships between significant variables and osteoporosis.

Results

There were 2401 respondents in this study with a male to female ratio of 1:1.49. The mean ± SD age of the respondents was 70.8 ± 7.7 years (males > females = 71.1 ± 7.9 > 70.6 ± 7.5 years) without a statistical difference (t = 1.533, $p = 0.125$). The median income of the respondents was 40,000 Naira (IQR 35,000 – 60,000) with the men significantly earning more than the women (45,000 Naira [IQR 40,000–70,000] vs. 40,000 Naira [IQR 30,000–45,000], Z = 11.098, $p < 0.0001$). The majority of the men (85.0%) were still married while the majority of the women (54.4%) were widowed. A higher proportion of the men (81.6%) had formal education compared with the women (53.5) (Table 1). The

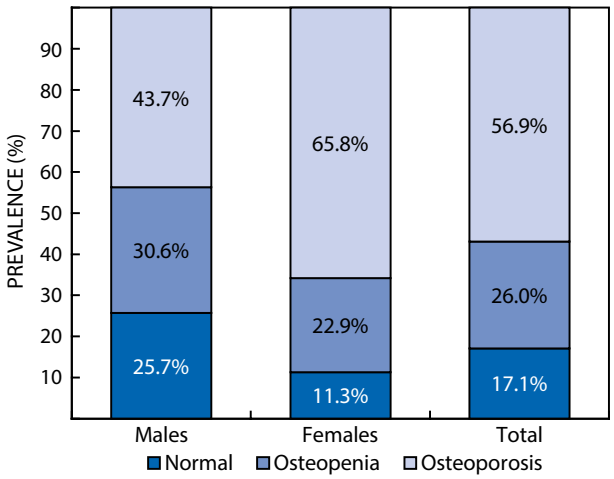

Figure 1: Point prevalence of osteopenia and osteoporosis using Dual Energy X-ray Absorptiometry (DXA).

Table 3: Medical history and lifestyle habits by prevalence of osteoporosis

Factor	Osteoporosis			
	Yes = 1366, *n* (%)	No = 1035, *n* (%)	Total = 2401, *n* (%)	
Do you engage in physical activities now?				
Yes	908 (54.1)	769 (45.9)	1677 (100.0)	$\chi^2 = 17.132$
No	456 (63.3)	266 (36.7)	724 (100.0)	$p < 0.0001$*
Do you take alcohol?				
Yes	9 (45.0)	11 (55.0)	20 (100.0)	$\chi^2 = 1.163$
No	1357 (57.0)	1024 (43.0)	2381 (100.0)	$p = 0.281$
Do you take tobacco				
Yes	0 (0.0)	5 (100.0)	5 (100.0)	$p = 0.010$†
No	1366 (57.0)	1030 (43.0)	2396 (100.0)	
Do you take vitamins and mineral supplements?				
Yes	443 (59.2)	305 (40.8)	748 (100.0)	$\chi^2 = 2.408$
No	923 (55.8)	730 (44.2)	1653 (100.0)	$p = 0.121$
Did you engage in sporting activities when you were in school or young?				
Yes	381 (44.0)	485 (56.0)	866 (100.0)	$\chi^2 = 91.878$
No	985 (64.2)	550 (35.8)	1535 (100.0)	$p < 0.0001$*
Are you on steroid therapy?				
Yes	27 (69.2)	12 (30.8)	39 (100.0)	$\chi^2 = 2.851$
No	1315 (56.8)	1001 (43.2)	2316 (100.0)	
Can't remember	24 (52.2)	22 9 (47.8)	46 (100.0)	$p = 0.240$
Do you have thyroid disease?				
Yes	8 (88.9)	1 (11.1)	9 (100.0)	
No	1358 (56.8)	1034 (43.2)	2392 (100.0)	$p = 0.052$†
Do you have any form of cancer?				
Yes	8 (72.7)	3 (27.3)	11 (100.0)	
No	1358 (56.8)	1032 (43.2)	2390 (100.0)	$p = 0.288$†
Do you have family history of fracture?				
Yes	5 (71.4)	2 (28.6)	7 (100.0)	$p = 0.437$†
No	1361 (56.9)	1033 (43.1)	2394 (100.0)	
Are you on anticonvulsant medications?				
Yes	10 (47.6)	11 (52.4)	21 (100.0)	$\chi^2 = 0.743$
No	1356 (57.0)	1024 (43.0)	2380 (100.0)	$p = 0.389$
Are you on peptic ulcer disease medications?				
Yes	104 (66.7)	52 (33.3)	156 (100.0)	$\chi^2 = 6.498$
No	1262 (56.2)	983 (43.8)	2245 (100.0)	$p = 0.011$*
Do you have chronic joint pains?				
Yes	662 (57.2)	496 (42.8)	1158 (100.0)	$\chi^2 = 0.069$
No	704 (56.6)	539 (43.4)	1243 (100.0)	$p = 0.793$
Your first admission to a hospital				
Never been admitted	857 (59.3)	588 (40.7)	1445 (100.0)	$\chi^2 = 32.544$
Before the age of 60 years	198 (44.8)	244 (55.2)	442 (100.0)	$p < 0.0001$*
After the age of 60 years	311 (60.5)	203 (39.5)	514 (100.0)	

*Significant at 5% level of significance.
†Fisher's exact test.

average distance walked daily by the respondent was 483 metres (males > females = 559.5 metres > 430 metres).

A total of 1366 respondents were diagnosed with osteoporosis, giving a point prevalence of osteoporosis of 56.9%. This is described in Figure 1. The socio-demographic characteristics by prevalence of osteoporosis are shown in Table 2. The prevalence of osteoporosis increases significantly with the age group from 39.7% in the 60–64 years age group to 75.6% in those above 80 years of age (χ^2 = 156.500, p < 0.0001). The prevalence of osteoporosis was higher among the female respondents compared with their male counterparts (65.8% vs. 43.7%; χ^2 = 114.800, p < 0.0001). The prevalence of osteoporosis was significantly associated with respondents who were not currently married, and had no formal education, non-engagement in occupational activities and were living with relatives/friends and being supported socially as well as financially by children or grandchildren.

Table 3 shows the medical history and lifestyle habits by prevalence of osteoporosis. The prevalence of osteoporosis was significantly associated with non-engagement in physical activities (χ^2 = 17.132, p < 0.0001), non-participation in sporting activities during school years (χ^2 = 91.878, p < 0.0001), usage of peptic ulcer medications (χ^2 = 6.498, p = 0.011) and being admitted to the hospital for the first time at or after the age of 60 years (χ^2 = 32.544, p < 0.0001).

Anthropometric measurements showed that the males were significantly taller than females (163.6 ± 7.4 cm > 153.2 ± 6.5 cm; t = 36.649, p < 0.0001) and significantly heavier (68.1 ± 14.9 kg > 66.4 ± 15.8 kg; t = 2.648, p = 0.008) than the females. However, the female respondents had higher mean ± SD waist circumference (98.6 ± 13.1 cm vs. 95.2 ± 12.4 cm; t = 6.530, p < 0.0001), hip circumference (106.1 ± 12.9 cm vs. 100.0 ± 30.5 cm; t = 6.739, p < 0.0001) and body mass index (28.3 ± 6.5 vs. 25.4 ± 5.0; t = 11.848, p < 0.0001) compared with the male respondents. Table 4 shows the anthropometric measurements by prevalence of osteoporosis. In both sexes, osteoporosis was significantly associated with having normal waist circumference (p < 0.0001) and being non-obese (p < 0.0001). The prevalence of osteoporosis was observed to have an inverse association with different categories of body mass index (BMI). This is shown in Figure 2.

Logistic regression analysis was carried out on significant variables associated with osteoporosis and this is shown in Table 5 (effect of age, sex, marital status, occupational activities, living arrangements, social and financial support, sporting activities while in school, first hospital admission, waist circumference, educational status, obesity and physical activities on the likelihood that the participants have osteoporosis). The logistic model was statistically significant, χ^2 (19) = 598.702, p < 0.0001. The model explained 29.6% (Nagelkerke R^2) of the variance in osteoporosis and correctly classified 72.3% of cases. The most significant variables associated with osteoporosis were age (OR = 1.069 [95% CI 1.054–1.084] p < 0.0001), female sex (OR = 4.061 [95% CI 3.133 – 5.263], p < 0.0001), not engaged in occupational activities (OR = 1.246 [95% CI 1.018–1.526], p = 0.033), living with relatives/friends (OR = 2.705 [95% CI 1.060–6.908], p = 0.037), receiving social support from relatives and friends (OR = 2.712 [95% CI 1.254–5.864), p = 0.011], receiving social support from children or grandchildren (OR = 3.482 [95% CI 1.553–7.805], p = 0.002), non-participation in sporting activities while at school (OR = 1.453 [95% CI 1.168–1.808], p = 0.001), using peptic ulcer disease medications (OR = 1.780 [95% CI 1.212–2.613], p = 0.003), hospitalisation after the age of 60 years (OR = 1.410 [95% CI 1.130–1.805], p = 0.006), normal waist circumference (OR = 1.953 [95% CI 1.495–2.551], p < 0.0001), having no formal education (OR = 1.376 [95% CI 1.088–1.740], p = 0.008) and not being obese (OR = 3.310 [95% CI 2.647–4.141], p < 0.0001). Each increase of one year in age produced a 6.9% (95% CI 5.4–8.4%) increase in the odds of having osteoporosis.

Table 4: Anthropometric measurements by prevalence of osteoporosis

Factor	Osteoporosis		
	Yes = 1366, *n* (%)	No = 1035, *n* (%)	Total = 2401, *n* (%)
Waist–hip Ratio (WHR)			
Males			
< 1.00	334 (45.1)	406 (54.9)	740 (100.0)
≥ 1.00	87 (38.8)	137 (61.2)	224 (100.0)
χ^2 = 2.771 df = 1; p = 0.096			
Females			
< 0.85	90 (65.7)	47 (34.3)	137 (100.0)
≥ 0.85	855 (65.8)	445 (34.2)	1300 (100.0)
χ^2 = 0.000 df = 1; p = 0.986			
Body mass index (BMI)			
Males			
Non-obese (< 30 kg/m^2)	385 (47.7)	422 (52.3)	807 (100.0)
Obese (≥ 30 kg/m^2)	36 (22.9)	121 (77.1)	157 (100.0)
χ^2 = 32.801 df = 1; p < 0.0001*			
Females			
Non-obese (< 30 kg/m^2)	710 (78.1)	199 (21.9)	909 (100.0)
Obese (≥ 30 kg/m^2)	235 (44.5)	293 (55.5)	528 (100.0)
χ^2 = 167.500 df = 1; p < 0.0001*			
Waist circumference (WC)			
Males			
Normal (< 94 cm)	259 (55.3)	209 (44.7)	468 (100.0)
Above normal (≥ 94 cm)	162 (32.7)	334 (67.3)	496 (100.0)
χ^2 = 50.354 df = 1; p < 0.0001*			
Females			
Normal (< 80 cm)	66 (88.0)	9 (12.0)	75 (100.0)
Above normal (≥ 80 cm)	879 (64.5)	483 (35.5)	1362 (100.0)
χ^2 = 17.380 df = 1; p < 0.0001*			

*Significant at 5% level of significance.

Discussion

Osteoporosis is a common metabolic bone disease that has attracted little attention and even less action in many developing countries including Nigeria and there are several reasons for this state of neglect.[18] These include the erroneous belief that osteoporosis is a disease limited to the developed countries and the acceptance of osteoporosis as an inevitable consequence of ageing.[18] This was a large study carried out among elderly respondents in the premier Geriatric Centre established in Nigeria.

Osteoporosis was found in more than half of the older patients in our setting. The prevalence of osteoporosis varies widely due to the differences in instruments used in measuring and the bones measured. Our prevalence was higher than that of adults aged 50 years and older in the US/European reference (38.3–47.7%),[19] Saudi Arabia (30.5–49.6%),[19] China (31%)[20] and India studies (20.3%).[21] Differences in the cut-off ages of adults in these studies could account for the disparities in prevalence values.

Table 5: Logistic regression analysis of significant variables associate with osteoporosis

Factor	B	Wald	p	OR	95% CI for OR	
					Lower	Upper
Age	0.066	84.789	0.001*	1.069	1.054	1.084
Sex (females)	1.401	112.076	0.001*	4.061	3.133	5.263
Currently married	−0.297	2.257	0.133	0.743	0.505	1.095
Not engaged in occupational activities	0.220	4.554	0.033*	1.246	1.018	1.526
Living arrangement		4.909	0.179			
With spouse	0.053	0.058	0.809	1.054	0.687	1.618
With children/grandchildren	−0.052	0.110	0.740	0.949	0.697	1.293
With relatives and friends	0.995	4.330	0.037*	2.705	1.060	6.908
Social support		11.475	0.009*			
From spouse	0.654	1.449	0.229	1.924	0.663	5.582
From children/grandchildren	1.247	9.173	0.002*	3.482	1.553	7.805
From relatives and friends	0.998	6.432	0.011*	2.712	1.254	5.864
Did no sporting activities while in school	0.374	11.252	0.001*	1.453	1.168	1.808
Using medication for peptic ulcer disease	0.576	8.656	0.003*	1.780	1.212	2.613
First hospital admission		7.651	0.022*			
Before the age of 60 years	0.128	1.125	0.289	1.138	0.897	1.441
After the age of 60 years	0.344	7.482	0.006*	1.410	1.103	1.805
Waist circumference (normal)	0.669	24.075	0.001*	1.953	1.495	2.551
Had no formal education	0.319	7.077	0.008*	1.376	1.088	1.740
Financially supported by others	0.511	20.954	0.001*	1.667	1.339	2.075
Not obese (BMI < 30 kg/m^2)	1.197	109.909	0.001*	3.310	2.647	4.141
Not engaged in physical activities	0.083	0.602	0.438	1.087	0.881	1.341
Constant	−5.632	72.056	0.000	0.004		

*Significant at 5% level of significance.

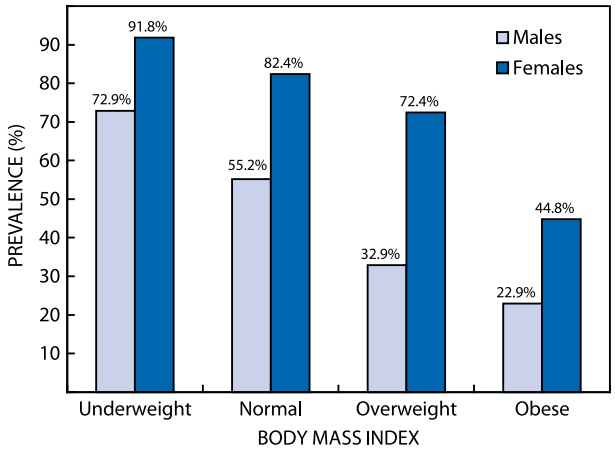

Figure 2: Body mass index by prevalence of osteoporosis.

Globally, osteoporosis has been reported to be more prevalent among older females compared with males due to their postmenopausal state. We found female sex to be an independent risk factor for developing osteoporosis with a fourfold risk among the older women. This was also reported in a Nigerian study in which a majority of those in the study group with osteoporosis were female.[1] The prevalence of osteoporosis among the female respondents (65.8%) was higher than that reported among the Moroccan older women (35.7%).[22]

We found a 6.9% increase in the risk of developing osteoporosis with each one-year increase in age. The association between age and osteoporosis was similarly reported in a hospital study in South-Western Nigeria.[1] Generally, bone formation and bone resorption processes are well balanced with no net change in the bone mass; however, bone formation exceeds bone resorption in the childhood and early adulthood periods. Between the ages of 30 and 40 years, the BMD plateaus, after which bone resorption exceeds bone formation with a decline in BMD throughout the rest of life, which in turn may lead to osteoporosis.[9]

Low education has been reported as an independent risk factor for the development of osteoporosis[23] and this was not different in our study as respondents without formal education had 1.4 times the risk of developing osteoporosis. Lifestyle habits of tobacco smoking and alcohol consumption in the respondents were not independently associated with osteoporosis. We could not draw any conclusion on this as few of the respondents engaged in these lifestyle habits. Also, the amount of alcohol consumed by the respondents was not ascertained. Studies have shown a dose–response relationship between tobacco smoking and osteoporosis.[24] However, the relationship between alcohol consumption and osteoporosis is unclear.[25]

Body size has been found to strongly influence bone mineral density and by extension the development of osteoporosis. Generally, obesity was thought to be protective against osteoporosis and fragility fracture, but a recent review has challenged this assumption.[26] Obesity causes increased mechanical loading from bodyweight and increases pancreatic secretion of hormones promoting bone homeostasis and formation.[26] In our study, however, obese respondents were at three times less risk of developing osteoporosis compared with those with normal body mass index.

Certain medications have been associated with the development of osteoporosis. We found a 1.8 increased risk of developing osteoporosis in respondents taking anti-peptic ulcer medications, which include antacids and proton pump inhibitors (PPIs), for long periods of time. Though studies varied on the pathogenesis of osteoporosis among persons taking PPIs, data have suggested a direct inhibitory effect on bone metabolism.[27]

Conclusions

The prevalence of osteoporosis was high among older patients in our settings with risk factors such as age, female sex, low education and prolonged use of peptic ulcer disease medications. Further longitudinal and community-based studies are needed to evaluate the predictive factors for developing osteoporosis.

Limitations

This study was hospital based, thus it is difficult to generalise its findings.

Authors' contributions – TA, LA and AO conceived the study. LA, OO and AO drafted the manuscript. ML, WB, VOA and TA critically reviewed the manuscript and made conceptual constructs. The final version of the manuscript was read and approved by all the authors.

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